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Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118-3686

Project No.:2014-101-TO3
December 9, 2016
Addendum No. 1

Attention: Mr. Joel Jenkins

****DRAFT****

Sub: Addendum No.1 to Geotechnical Investigation Report
Main Avenue and Madrone Pipeline Restoration Project
Santa Clara County, California

Ref: Geotechnical Investigation Report dated May 2016

Dear Mr. Joel Jenkins:

This addendum addresses the geotechnical recommendations for the underground structures which were added to the “Main Avenue and Madrone Pipeline Restoration Project" subsequent to the submission of the “Geotechnical Investigation Report for Main Avenue and Madrone Pipeline Restoration Project” dated May 2016 by Parikh Consultants, Inc. (PARIKH) (Geotechnical Report)

1. Proposed Underground Structures

The following are the proposed underground structures based on the “Proposed Scope and Services” in the “Main Avenue and Madrone Pipeline Restoration Project Geotechnical Investigation Task Order 3 – Amendment 1” (Amendment 1) provided by Santa Clara Valley Water District (District).

TABLE 1 - SUMMARY OF UNDERGROUND STRUCTURES

No. (1)	Name of Structure	Description of Structure
1	Traffic Vault	8’ x 10’ precast vaults 7’-6” deep
3, 4	Traffic Vault	
2	Chemical Feed Station	14’ x 18’ blockhouse. Lower level will be 10’ deep
5	Pressure Relief Valve Vault	12’ x 12’ concrete pressure regulating valve vaults 7’-8” deep
7	Pressure Relief Valve Vault	
6	Outlet Structure	At a depth of 9’ below ground surface
8	Energy Dissipater	

(1) Number used in the “Proposed Structure Location Map” in Attachment 1.

2. Available Boring

A total of fourteen borings (Borings B-01 through B-14) were drilled to the depth of 21.5 feet for the "Main Avenue and Madrone Pipeline Restoration Project" in August 2015.

Some of these boings are in the vicinity of the proposed underground structures and used as reference borings to provide subsurface soil conditions information for the geotechnical recommendations. Majority of the proposed structure are in close proximity to the available borings drilled by PARIKH in August 2015 except for the proposed "Chemical Feed Station" and "Value Vaults" which are approximately midway at a distance between Borings B-12 and B-13 along Main Avenue. Based on the review of the borings in the vicinity of these proposed structures, the subsurface soil conditions generally consist of very stiff to hard lean clay underlain by hard lean clay/dense to very dense silty sand with gravel. In our opinion, Boring information from Borings B-12 and B-13 appear to be adequate for the geotechnical recommendations of the proposed "Chemical Feed Station" and "Value Vaults".

The name and location of the structure and adjacent soil boring are summarized in the table below:

TABLE 2 - SUMMARY OF AVAILABLE BORINGS

No.	Name of Structure	Location of Structure	Adjacent Boring
1	Traffic Vault	Intersection of Cochrane Road and Half Road	B-7
3, 4	Traffic Vault	Next to Chemical Feed Station	B-12 and B-13
2	Chemical Feed Station	Near East Main Avenue	
5	Pressure Relief Valve Vault	Near the proposed Chemical Feed Station on East Main Avenue near Hill Road.	B-13
7	Pressure Relief Valve Vault	Southwestern end of Half Road near the Madrone Channel.	B-1
6	Outlet Structure	At the Main Avenue Pond site	B-14
8	Energy Dissipater	Southwestern end of Half Road near the Madrone Channel.	B-1

3. Subsurface Soil Conditions

The subsurface soil conditions of the reference boings available in the vicinity of the proposed underground structures are summarized in the table below.

TABLE 3 - SUMMARY OF SUBSURFACE SOIL CONDITIONS

No.	**Name of Structure**	**Boring No.**	**Depth of Structure**	**Subsurface Soil Conditions**
1	Traffic Vault	B-07	7’-6”	Medium dense to very dense silty sand with gravel, underlain by dense poorly-graded sand to the boring depth.
2	Chemical Feed Station	B-13	10’-0”	Very stiff to hard lean clay with sand/gravelly lean clay, underlain by dense clayey gravel with sand to the boring depth.
3, 4 & 5	Traffic Vault and Pressure Relief Valve Vault	B-13	7’-6” and 7’-8”	Very stiff to hard lean clay with sand/gravelly lean clay, underlain by dense clayey gravel with sand to the boring depth.
6	Outlet Structure	B-14	9’-0”	Hard lean clay, underlain by dense to very dense silty sand with gravel/clayey gravel with sand to the boring depth.
7	Pressure Relief Valve Vault	B-01	7’-8”	Hard lean clay with gravel, underlain by dense to dense clayey sand with gravel to the boring depth.
8	Energy Dissipater	B-01	9’-0”	Hard lean clay with gravel, underlain by dense to dense clayey sand with gravel to the boring depth.

4. Foundation

Foundation Subgrade Subsurface Soil Conditions

The general subsurface soil conditions at the depth of the underground structure is summarized in the table below:

TABLE 4 - SUMMARY OF FOUNDATION SUBGRADE SUBSURFACE SOIL CONDITIONS

No.	**Name of Structure**	**Boring No.**	**Depth of Structure (ft)**	**Subsurface Soil Conditions**
1	Traffic Vault	B-07	7’-6”	Medium dense to very dense silty sand with gravel.
2	Chemical Feed Station	B-13	10’-0”	Hard lean clay with sand.
3, 4 & 5	Traffic Vault and Pressure Relief Valve Vault	B-13	7’-6” and 7’-8”	Hard lean clay with sand.
6	Outlet Structure	B-14	9’-0”	Hard lean clay/dense to very dense silty sand with gravel.
7	Pressure Relief Valve Vault	B-01	7’-8”	Hard lean clay with gravel.
8	Energy Dissipater	B-01	9’-0”	Hard lean clay with gravel.

Recommended Bearing Capacity

TABLE 5 - SUMMARY OF ALLOWABLE BEARING CAPACITY

No.	**Name of Structure**	**Undrained Shear Strength/Friction Angle Used in Analyses (psf)**	**Allowable Bearing Capacity (ksf)**	
			Dead Load	**Dead Load + Live**
			F.O.S. = 3.0	**F.O.S. = 2.0**
1	Traffic Vault	35-degree	9.7	14.5
2	Chemical Feed Station	4000	6.7	10.0
3 & 4	Traffic Vault	4000	8.7	13.0
5	Pressure Relief Valve Vault	4000	8.7	13.0
6	Outlet Structure	4000	10.0	15.0
7	Pressure Relief Valve Vault	3750	8.8	13.2
8	Energy Dissipator	3750	9.1	13.7

A Factor of Safety of 3.0 is applied for dead load only and a Factor of Safety of 2.0 is applied to dead load plus live load assuming the live loads are temporary. The above allowable bearing capacities for dead plus live loads may be increased by one-third for short term seismic and wind loads.

If loose/soft soil material is encountered in the foundation subgrade, the foundation subgrade surface should be scarified to a minimum depth of six inches (6") below the final subgrade elevation. All lose/soft soil material, boulders or solid rock encountered should be removed. All areas to receive fills should be uniformly moisture conditioned as required and re-compacted to obtain the required percentage of relative compaction in accordance with the project specifications. The resulting surface upon which fill is to be placed should be observed by the Geotechnical Engineer.

5. Lateral Earth Pressures and Friction Coefficient

The proposed structures should be designed to resist the following "Applied Lateral Earth Pressures" (Equivalent Fluid Pressures-EFP) and live load. The wall backfill should consist of structure backfill behind the wall.

The backfill material behind the structures should be the Caltrans "Structure Backfill" (Caltrans Standard Specifications Section 19). The structure backfill must have a sand equivalent value of at least 20 and comply with the grading requirements shown in the table below:

Sieve size	Percentage passing
3”	100
No. 4	35-100
No. 30	20-100

The excavated soil material at the project site can be used as the structure backfill provided the soil material is tested to be conforming to the Caltrans’ specifications for structure backfill.

For the lateral design of the proposed structures, the following lateral earth pressures (Equivalent Fluid Pressures) and design parameters should be used:

TABLE 6 - SUMMARY OF LATERAL EARTH PRESSURES

Design Loading Condition	Structure Backfill
Active	24.0 pcf + hydrostatic pressure (62.4 pcf)
At-rest	35.5 pcf + hydrostatic pressure (62.4 pcf)

(a) The available ultimate passive resistance against the side of the proposed structure footing is 455 pcf EFP (Assume Ø’=28-degree for native soil). According to Caltrans Bridge Design Specifications (August 2003) Section 5 (5-47), not more than 50% of the available passive lateral earth pressure shall be considered in the determination of the factor of safety against sliding when combining passive and bottom friction.

(b) A coefficient of friction of 0.34 may be used to estimate the frictional resistance along the bottom of the footing on native soil. Only the dead loads should be used to estimate the frictional resistance at the bottom of footings.

Structure Walls, which are free to rotate at least 0.005 radii, may be assumed flexible and designed for the active condition. Wall of the proposed structure that are not capable of this movement should be assumed rigid and designed for the at-rest condition. The effect of any surcharge (dead, live or traffic load) should be added to the preceding lateral earth pressures. A coefficient of 0.35 and 0.5 may be used to determine the additional earth pressure resulting from the surcharge for the flexible (active) wall and rigid (at-rest) wall, respectively. The resultant pressure distribution is rectangular. When traffic is anticipated within a horizontal distance of one half of the wall height, Caltrans design practice is to add an equivalent earth pressure of 240 psf.

6. Design for Uplift Pressures

Groundwater

Groundwater was not encountered in any of the fourteen borings during drilling in August 2015 with the maximum boring depth of 21.5 feet. Also, none of the soil samples collected from these borings was described as "wet". Monitoring wells were installed in Borings B-01, B-07 and B-14 in August 2015 to allow groundwater monitoring. Groundwater was measured in the these monitoring wells from October 2015 to March 2016 with the following summary:

TABLE 7 - SUMMARY OF GROUNDWATER MONITORING

Boring Number	Encountered Groundwater Level		
	Date Measured	Depth (ft)	Approx. Elev. (ft)
B-01	10/15/2015	18.9	364.6
	12/24/2015	19.0	364.5
	03/10/2016	18.9	364.6
B-07	10/15/2015	20.3	402.7
	12/24/2015	16.3	406.7
	03/10/2016	13.1	409.9
B-14	10/15/2015	12.0	383.0
	12/24/2015	13.6	381.4
	03/10/2016	14.5	380.5

According to the "Santa Clara Valley Water District 10-Year Groundwater Elevation Data from 1/2006 to 1/2016", groundwater was measured to the depth of 15.5 feet (NGVD29 Elev. 374.6 feet) on December 22, 2015 from the monitoring well installed at E. Main Avenue.

It appears that the minimum depth to the groundwater level that has been measured is greater than the maximum structure depth of 10 feet for the Chemical Feed Station. The groundwater level is anticipated to vary with the passage of time due to seasonal groundwater fluctuations, variations in yearly rainfall, water elevations in the nearby creeks, surface and subsurface flows, ground surface run-off, and other environmental factors that may not be present at the time of the investigation.

Based on the measured groundwater levels, a groundwater depth of 10 feet was assumed for engineering design purposes only in the "Main Avenue and Madrone Pipeline Restoration Project". The proposed underground structures are unlikely to be subject to submerged or partially submerged conditions. We recommend the groundwater in the monitoring wells to be measured prior to the construction of the proposed structures.

Uplift Resistance

The buoyant uplift force acting on the proposed structures may be resisted by a combination of the dead weight of the structures and the friction between the structure walls and the adjacent soils. To estimate the frictional resistance, a coefficient of friction of 0.30 is recommended between the walls and the adjacent structure backfill. The horizontal pressure acting on the wall may be calculated as 0.4 times the corresponding vertical pressure at depth. For design purposes, the vertical pressure at depth may be estimated using soil unit weight of 120 pcf and 68 pcf above and below the design groundwater level, respectively.

In the event that additional uplift resistance is needed, the foundation may have to be enlarged beyond the walls to engage additional weight of the backfill.

7. Construction Consideration

Construction activities related to excavation and lateral earth support must conform to the safety requirements of Occupational Safety and Health Administration (OSHA) and other applicable municipal and State regulatory agencies. Construction consideration such as temporary excavation, shoring, excavation stability and dewatering etc. are briefly described below and more detail should be referred to the geotechnical report.

Temporary Excavation Slope

(a) All temporary excavation should be made in accordance with the California OSHA Safety Standards and should be designed based on the existing soil/site condition.
(b) According to OSHA guidelines, the subsurface soils are generally Type B soils and the temporary, un-surcharged slope should not be steeper than 1H: 1V.
(c) Exposed slope should be kept moist (not saturated) during construction and the groundwater maintained a minimum of 3 feet below the bottom of excavation at all time during construction.
(d) Medium dense silty sand with gravel was encountered at shallow depth in Boring B-07. Medium dense sand is likely to be encountered within the depth of excavation during construction of Traffic Vault which is in the vicinity of Boring B-07.
(e) Adequate surface protection should be provided to protect the temporary slope surface from erosion, excessive drying and/or saturation during construction.

Details of temporary excavation slope should be referred to Section 11.1 of the geotechnical report.

Shoring System

(a) Shoring operations should be conducted in accordance with the applicable California OSHA codes.
(b) Active shoring system should be designed with as many supports or struts as necessary to prevent excessive straining and deformation of the supported soils.
(c) Sheeting should be driven to a sufficient depth below the excavation to prevent bottom instability. Bracing should also be installed as soon as practical against the continuous sidewall support.
(d) Lateral earth pressure for the design of sheeting or shoring systems should be referred to Plate No. 12 of the geotechnical report.
(e) Contractor should be encouraged to verify the soil conditions in order to satisfy their design requirements and to provide adequate shoring for the project.

Details of shoring system should be referred to Section 11.1.2 of the geotechnical report. Discussion for the protection of existing utilities should be referred to 11.5 of the geotechnical report.

Excavation Bottom Stability

(a) Any potential for bottom heave and/or “blow-out” should be monitored during excavation. Deep shoring system and construction dewatering may be required to mitigate the condition.
(b) Contractor should take adequate measures to minimize the disturbance of the sensitive deposits at the bottom of excavation.

Details of excavation stability and working platform should be referred to Section 11.2 and Section 11.3 of the geotechnical report.

Dewatering

(a) Perched water table may be encountered if excavation is performed in winter or early spring. Localized dewatering should be less likely if the excavation is performed during the summer months.

(b) Groundwater should be verified by the contractor before construction and monitored during construction. A properly designed and constructed dewatering operation may be required. Groundwater should be maintained at least 3 feet below the bottom of the excavation at all times during construction.

(c) All dewatering schemes proposed by the contractor should be submitted to the Santa Clara Valley Water District prior to implementation.

Details of dewatering should be referred to Section 11.4 of the geotechnical report.

8. Quality Control During Construction

The following quality control can be considered during construction:

Backfill of Excavation

(a) Frequency of test for the backfill should be clearly defined.
(b) Responsibility for the compaction testing should be clearly designated.
(c) The compaction requirements and control of moisture contents etc. should be clearly conveyed to the Contractor in the pre-construction meeting.
(d) All the test results confirming compliance with the project specifications should be documented and recorded.
(e) Reporting procedure for non-compliance of compaction test results and corrective action to be taken.

Foundation Subgrade Inspection

(a) The foundation subgrade should be inspected by Geotechnical Engineer prior to concreting for the footing of the structure.

Shoring Design and Construction

(a) The Contractor should have the shoring system designed and signed by a Registered Engineer. The calculations for the shoring design should be reviewed by PARIKH to check the geotechnical parameters used in the calculations to be consistent with those recommended in the geotechnical report.
(b) Any ground settlement and/or lateral movement due to shoring deflection should be monitored during construction. Any excessive ground settlement and/or lateral deflection should be reported to the Engineer for mitigation.

9. Investigation Limitations

Please be advised that we are performing a professional service and that our findings are professional opinions only. All work done and all recommendations made are in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

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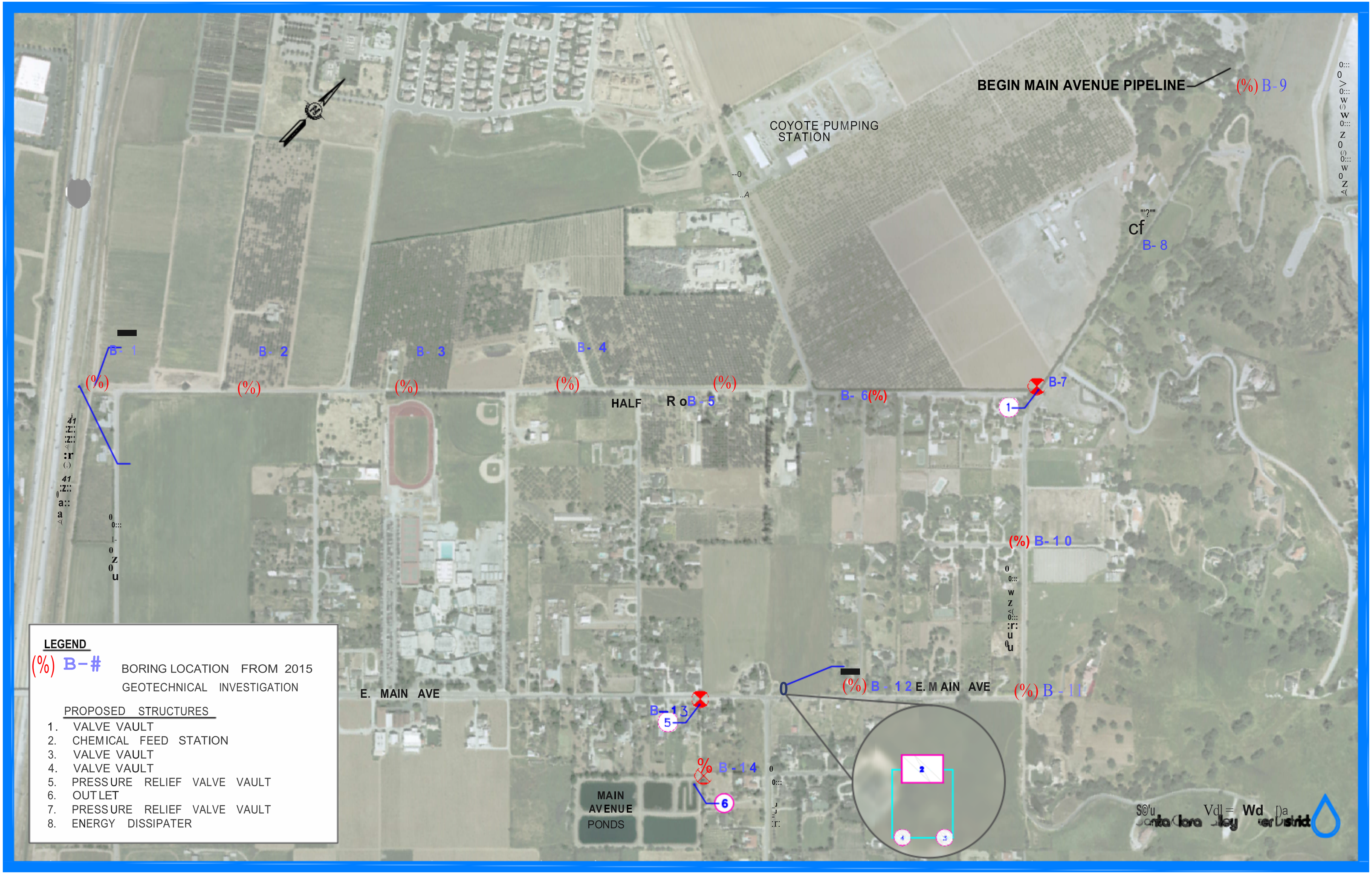
Attachment 1 - “Proposed Structure Location Map”.



LEGEND

(%) B-# BORING LOCATION FROM 2015 GEOTECHNICAL INVESTIGATION

PROPOSED STRUCTURES

1. VALVE VAULT
2. CHEMICAL FEED STATION
3. VALVE VAULT
4. VALVE VAULT
5. PRESSURE RELIEF VALVE VAULT
6. OUTLET
7. PRESSURE RELIEF VALVE VAULT
8. ENERGY DISSIPATER